Foreword

Separation science was first recognized as a distinct area of physical and analytical chemistry in the 1960s. The term was first coined, I believe, by the late J. Calvin Giddings, Research Professor at the University of Utah. Calvin Giddings recognized that the same basic physical principles governed a wide range of separation techniques, and that much could be learnt by applying our understanding of one such technique to others. This was especially true for his first loves, chromatography and electrophoresis and latterly field flow fractionation. Of course there are many separation techniques other than chromatography, many with a history at least as long, or indeed longer, than that of chromatography: distillation, crystallization, centrifugation, extraction, flotation and particle separation, spring to mind. Other separation techniques have emerged more recently: affinity separations, membrane separations and mass spectrometry. Most people, a few years ago, would not have classed mass spectrometry as a separation technique at all. However, with modern ionization methods, which minimize fragmentation, mixtures of compounds can first of all be separated and then each component identified through fragmentation by secondary ion-molecule collisions and further mass spectrometry. With the scale of mass spectrometry now matching that of microseparation methods such as capillary electrophoresis and capillary electrochromatography, combinations of orthogonal methods can now provide extremely powerful separation and identification platforms for characterizing complex mixtures.

Basically, all separation techniques rely on thermodynamic differences between components to discriminate one component from another, while kinetic factors determine the speed at which separation can be achieved. This applies most obviously to distillation, chromatography and electrophoresis, but is also obvious in most of the other techniques; even particle size separation by sieving can be classified in this way. The thermodynamic aspect is, of course, trivial being represented by the different sizes of the particles, as indeed it is for the size exclusion chromatography of polymers. However, the kinetic aspects are far from trivial. Anyone who has tried to sieve particles will have asked the question: is it better to fill the sieve nearly to the top and sieve for a long time, or is it better to dribble the material slowly into the sieve and just remove the heavies from time to time? One might further ask: how does one devise a continuous sieving process where large particles emerge from one port of the equipment, and small ones emerge from the other port? And how does one optimize throughput and minimize unit cost?

DropBooks

The publication of this *Encyclopedia of Separation Science* is a landmark for this area of science at the start of the third millennium. It will undoubtedly be of enormous value to practitioners of separation science looking for an overview and for guidance as to which method to select for a new problem, as well as to those who are at an early stage, simply dipping their toes into the waters, and trying to find out just what it is all about. Most important of all, by providing a comprehensive picture, it advances the whole field of separation science and stimulates further work on its development and application. The publishers, their editors and their authors are to be congratulated on a splendid effort.

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